16.36 Communication Systems Engineering
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MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Aeronautics and Astronautics

16.36: Comm. Sys. Engineering
Problem Set No. 8

Problem 1

Show that the final parity check in a horizontal and vertical parity check code, if taken as the modulo-2 sum of all the data bits, is equal to the modulo 2 sum of the horizontal parity checks and also equal to the modulo 2 sum of the vertical parity checks.

Problem 2

Consider the parity check code with three data bits and four parity checks. Suppose that three of the code words are 1000111, 0101011, and 0011101. Find the rule for generating each of the parity checks and find the set of all eight code words. What is the minimum distance of this code?

Problem 3:

A (7,4) cyclic code has generator polynomial $p^3 + p + 1$.

A) What is the generator matrix G for this code, in systematic form?

B) Provide the shift register implementation of the CRC generator. What is the codeword for information sequence M=1001? Show the register contents after each shift and the final CRC.

Problem 4:

For a cyclic code with generator sequence G=101101, suppose the received sequence of bits is T=11100000111. Did any errors occur?

Problem 5: Stop and Wait ARQ

A) A geosynchronous satellite has a half-duplex channel with a transmission rate of 10 kbps and a propagation delay of 0.25 sec each way. With a data packet size of 1000 bits and a loss probability p of 10^{-3}, what is the expected transmission time of a packet in this system? (Assume the acknowledgement packets are very small and $D_{TA} = 0$.) What is the efficiency of the system?

B) Suppose the minimum acceptable efficiency is 50%. Assuming all other parameters are the same as part (a), what is the longest channel propagation delay for which we can still use stop-and-wait?